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# (12) UK Patent Application (19) GB (11) 2 255 399 A

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(56) Documents cited  
 GB 2202311 A GB 2152648 A EP 0416394 A2  
 WO 88/00625 A1 DE 003728080 A US 4004566 A

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 INT CL<sup>6</sup> F41B 11/00 11/02  
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## (54) Magazine systems

(57) The present invention concerns a magazine mechanism for use especially with an airgun supplied with pressurised gas stored in a reservoir within the gun and obtained from a separate gas-charged canister connected to the gun, comprising a magazine *per se* in the form of an elongate pellet carrier (23) with spaced along it a number of pellet-holding through holes (26), each hole having associated therewith an indexing pin (25) projecting laterally of the carrier orthogonally of the hole, the carrier (23) being mountable in and across the breech (13) for sideways movement therethrough, and the system also having an indexer plate (28) carrying indexing guide walls (31, 32) co-operating with the holder's indexing pins (25), the plate being so mounted on the bolt/pusher (14) that it moves back and forth therewith, and as it does so the indexing guides (31, 32) thereon interact with the carrier's indexing pin (25) to drive the carrier (23) sideways through the breech bringing each pellet-holding throughhole (26) in line with the chamber (12) one after another with successive actions of the bolt. The holes 26 have a lip at one end and an O ring seal at the other to retain the pellets.

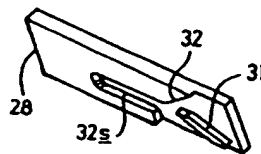


Fig. 4A

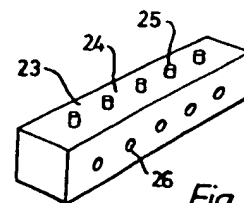


Fig. 4B

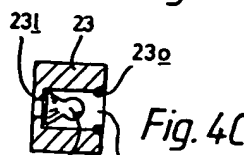


Fig. 4C

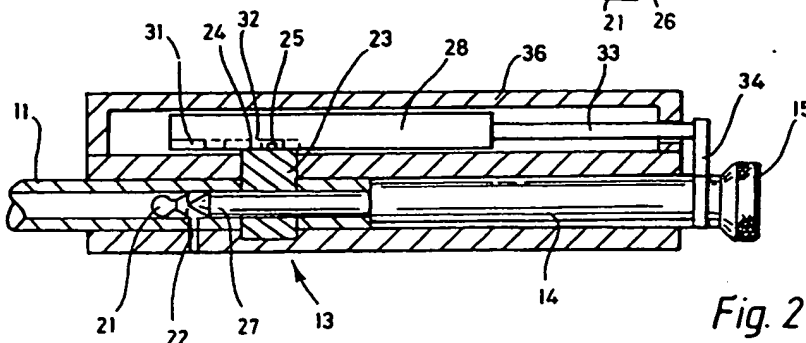


Fig. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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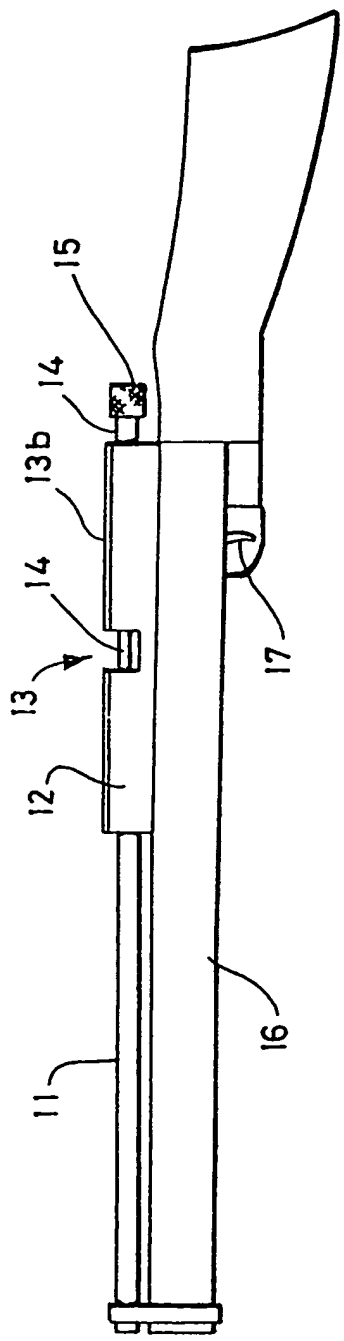


Fig 1

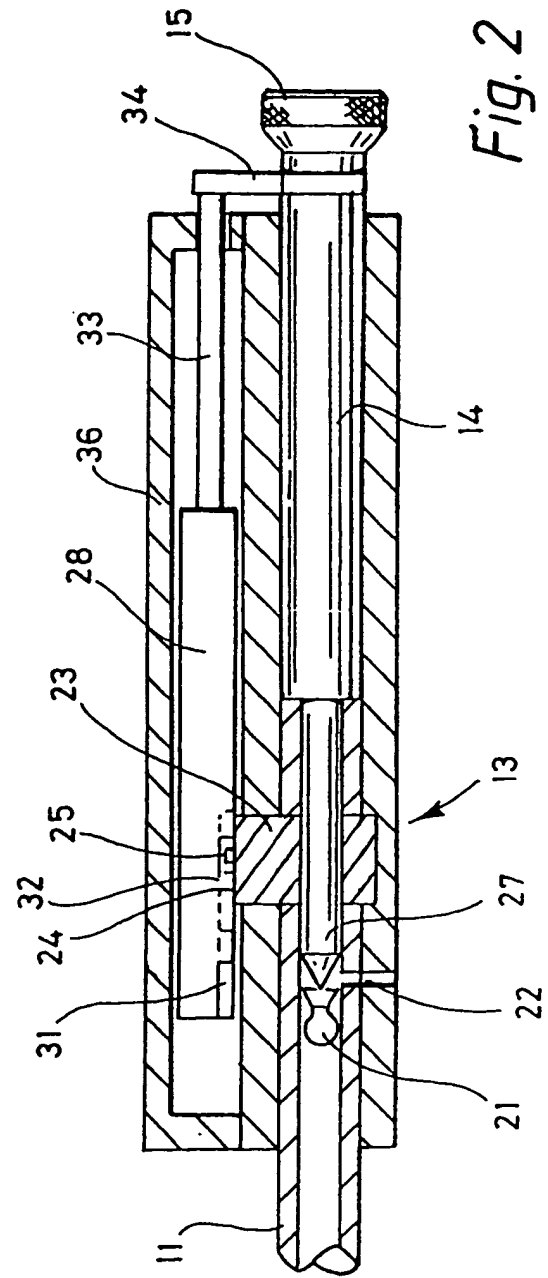


Fig. 2

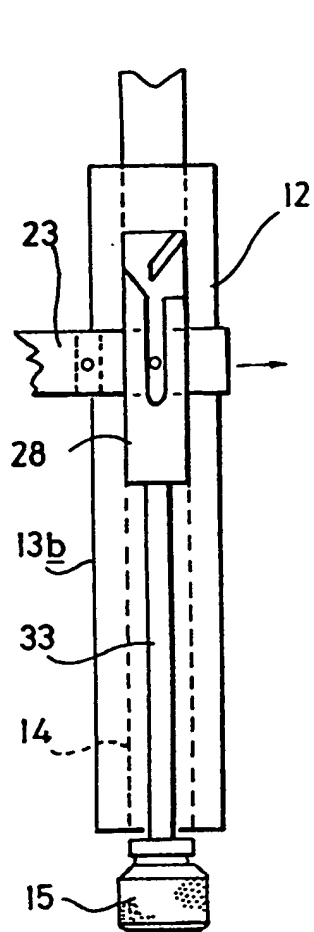


Fig. 3A

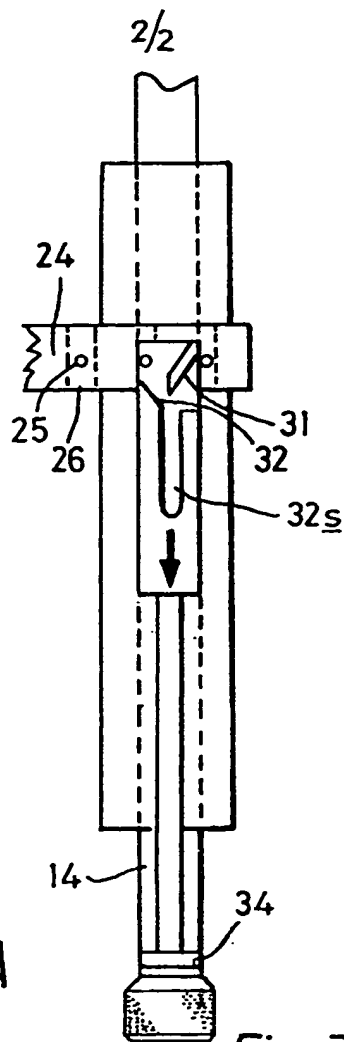


Fig. 3B

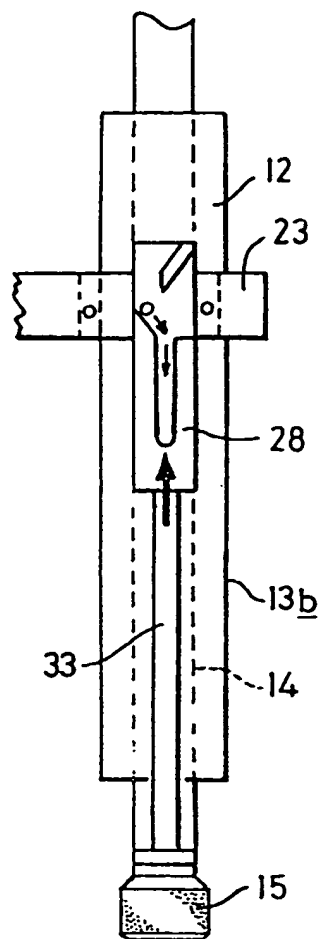


Fig. 3C

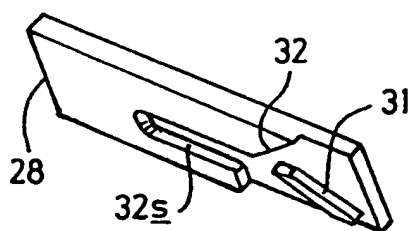


Fig. 4A

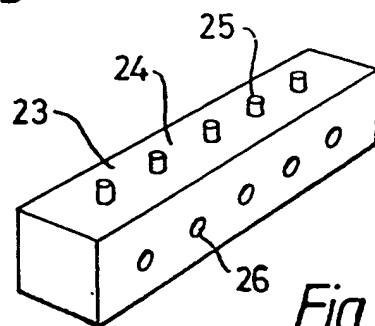


Fig. 4B

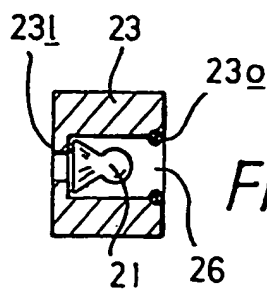


Fig. 4C

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Magazine Systems

This invention relates to magazine systems, and concerns especially mechanisms for ammunition magazines, for storing the ammunition for loading into guns, particularly airguns.

Since the invention of the gun much effort has been expended on ways to load it more efficiently and more rapidly, particularly by the method of storing the ammunition in a clip, or magazine, that can be inserted into the gun at the rear of the barrel and from which the individual rounds may be taken, preferably by some sort of automatic mechanism associated with the firing of the gun itself, and loaded one at a time into the breech/chamber/barrel. The present invention concerns a novel magazine mechanism for use with an airgun - that is, the sort of gun that propels the round/bullet/pellet along and out of the barrel by pressurised/compressed gas (usually air, but sometimes carbon dioxide) stored commonly in a reservoir within the gun and obtained either from a pump built in to the gun or from a separate gas-charged canister connected to the gun (canisters of the type actually mounted on the gun commonly hold sufficient pressurised air for from 100 to 200 shots). Indeed, the invention is especially suited for use with the latter variety - the pre-charged gun - where the benefits of not having to pump the gun to re-charge it are, as a result of employing magazine loading, not nullified by having to insert each round into the chamber by hand.

The significant operating parts of such an airgun are:

the barrel, with a chamber (at its rear end) into which must be inserted the pellet as a near gas-tight fit;

the breech, to the rear of the chamber and into which is placed the pellet (normally by hand) so that it may then be pushed into the chamber;

the bolt (or pusher) behind and in line with the chamber/breech, and movable between a drawn back position, where it leaves the breech open ready to receive a pellet, and a pushed forward position, where it closes off the breech, pushes the pellet placed therein into the chamber ready for firing, and seals off the chamber; and finally

a pressurised/compressed gas reservoir connectable via a trigger-operated valve mechanism to the chamber just behind the pellet so that, on operation of the trigger, the gas in the reservoir expands into the chamber behind the pellet, and drives the pellet up, and out of, the barrel.

The invention proposes a magazine system, or mechanism, for use in such an airgun, the system having a magazine per se in the form of an elongate pellet carrier with spaced along it a number of pellet-holding throughholes, each hole having associated therewith an indexing pin projecting laterally of the carrier orthogonally of the hole, the carrier being mountable in and across the breech for sideways movement therethrough, and the system also having an indexer plate carrying indexing guide walls co-operating with the holder's indexing pins, the plate being so mounted on the bolt/pusher that it moves back and forth therewith, and as it does so the indexing guides thereon interact with the carrier's indexing pin to drive the

carrier sideways through the breech bringing each pellet-holding throughhole in line with the chamber one after another with successive actions of the bolt. The system of the invention is mechanically simple (and therefore inexpensive to make), and has the advantage that it may easily be retro-fitted to existing airguns.

In one aspect, therefore, the invention provides a magazine system for use with an airgun of the sort having a source of pressurised gas feedable to an inlet into a chamber, a breech into which is loaded a pellet, and a bolt to push the pellet into the chamber to and past the gas inlet, which system comprises a combination of:

a magazine pellet carrier with an elongate body and a multiplicity of spaced pellet-holding throughholes therein and a like number of indexing pins projecting therefrom orthogonally to holes and body, each pin associated with its own throughhole, the magazine adapted to fit across the breech with any one of its succession of pellet-carrying holes aligned with the chamber,

together with a magazine-advance mechanism attached to and operated by the bolt, the mechanism comprising an indexer plate projecting forwardly of the bolt adjacent the breech, and carrying on its breech-adjacent surface indexing guides that interact with the indexing pins of a magazine placed in the breech and by so doing cause the magazine to be driven bodily sideways through the breech as the bolt is worked, until the next throughhole is aligned with the chamber, so that the subsequent forward movement of the bolt pushes the pellet in that hole out and into the chamber.

The magazine system of the invention is for use with an airgun of the sort having a source of pressurised gas feedable to an inlet into a chamber, a breech into which is loaded a pellet, and a bolt to push the pellet into the chamber to and past the gas inlet - thus, the sort of "conventional" airgun described in more detail hereinbefore. Nothing further need be said on this subject, except perhaps to note that preferably the airgun is of the variety having a separate pressurised air canister attached thereto, as described hereinafter with reference to the accompanying Drawings.

The inventive magazine system comprises a pellet carrier/holder co-acting with an indexer plate operatively linked with the bolt. The carrier has an elongate body having a succession of throughholes therein, and is conveniently a thin oblong of material - a metal like aluminium or steel, or a plastics substance such as a nylon or a polyalkylene - in size and overall shape rather like a small bar of chocolate. Typically it is about 3x1x $\frac{1}{8}$  in (7x2 $\frac{1}{2}$ x $\frac{1}{8}$  cm), but in reality only the width and thickness are significant, for it must fit the breech and it must be of a thickness to hold a pellet yet let the bolt push it out into the chamber.

The carrier has throughholes in which to carry pellets, and the latter must be retained in the holes sufficiently well to prevent them falling out but not to stop the bolt being able to push them out into the chamber. It is possible to make the holes of such a size that the pellets are a friction fit therein, but this risks damaging the pellets (so they may not then fit properly in the chamber), and so it is best to provide some sort of pellet-retaining means at both the front and the rear ends of the hole. The simplest would seem to be an O-ring, of some elastically-deformable



material such as a natural or synthetic rubber, mounted at the front of the hole, and a small inwardly-projecting lip at the rear; the pellet can then be loaded into the magazine by pushing it (backwards) by hand into the hole past the front O-ring until it stops against the rear lip, whereupon it will be safely retained in the hole until, in due course, the bolt advances from the rear through the lipped rear opening to contact the rear of the pellet and push it out past the front O-ring and into the chamber.

There may naturally be as many throughholes as required, subject to the sheer length of the magazine being acceptable. Indeed, one might have magazines of different sizes - numbers of holes - for different purposes (and one might even have a substantially infinite magazine, in the form of an endless belt). However, one appropriate size is six holes, giving six shots before the magazine must be replaced with a full one.

The throughholes are spaced, and the spacing is that needed to ensure both suitable physical strength - the magazine must not easily warp or twist through careless handling or use - and operational sufficiency - the distance between holes must be appropriate to the width of the breech and the ability of the indexing system to move the magazine sideways through the breech to align each hole in succession with the chamber. A practical spacing is 5/16 in (8 mm) measured centre to centre, though a rough range, from minimum to maximum, is 6 mm to 10 mm (depending, of course, on the size of the pellet). A six-shot magazine with the practical spacing is thus about 2 in (5 cm) long (at either end there is a hole-free length of 10 mm).

Projecting laterally of - from the edge/side of - the magazine, orthogonally to the holes (and thus normal to their axes and to the line of the succession of holes), are the indexing pins, one per hole. These pins, which may project from either the top or the bottom edge of the magazine when in situ (though from the top is preferred, so as not to cause interference with the trigger mechanism), are part of the mechanical link between the magazine and the indexer plate (the other part is the indexing guides on the plate) that allows movement of the bolt-attached plate to drive the magazine sideways - that is, from left to right (or vice versa), rather than front to back - through the breech, to bring each throughhole in succession into line with the chamber. The pins are simply short upstanding lugs (or spigots or columns), that enable the guides on the indexer plate to locate and "grip" the magazine. They are associated one with each throughhole, and may conveniently be slightly (about 1 to 2 mm towards the side opposite to the magazine feed direction) offset therefrom (provided the indexing guides are similarly offset), to stand mainly in the spaces between holes, to simplify the construction and operation of the magazine.

In the magazine system of the invention the magazine is used together with an advance mechanism attached to and operated by the bolt. It is this advance mechanism that drives the magazine through the breech, successively aligning each throughhole with the chamber, as the bolt is operated. Basically, and starting with a hole so aligned and the bolt end passing therethrough having previously pushed the pellet therein forward into the chamber: as the bolt is drawn back and clears the throughhole the indexer plate guides engage the relevant magazine pin and drive the magazine

sideways a little, disengaging as the bolt is pulled right back (so that the magazine can then be extracted from the breech if required); and then as the bolt is driven forwards the guides re-engage to drive the magazine further sideways to complete the movement and align the next throughhole with the chamber, final forward movement of the bolt then both pushing the pellet in that throughhole out into the chamber and thereafter sealing the chamber ready for firing.

The indexer plate is essentially an elongate plate mounted adjacent the breech - above the breech is preferred (below is possible, but means a re-design of the trigger mechanism) - and attached to the bolt so that as the bolt moves back and forth so the plate moves likewise. This attachment may take a number of forms - for instance, it may be by way of an upstanding arm near the middle of the bolt - but to avoid the necessity for significantly modifying the basic gun design it is preferred, as shown in the accompanying Drawings, that it be a rearwardly-pointing rod extending back well behind the breech block and there secured by a short crank arm to the bolt near its rear end (the end that in use is gripped and pushed, pulled and twisted by the shooter to operate the bolt. The crank arm needs be so secured to the bolt that the bolt may be axially rotated (to lock it into the breech-closed position) without the arm/rod/plate trying to rotate as well, and this is easily achieved by attaching the arm to the bolt by a ring coupling fitted loosely around the bolt in a shallow groove formed therein.

The indexer plate carries on its breech-adjacent surface (preferably, its undersurface) indexing guides that interact with the indexing pins of a magazine placed in the breech. These guides are such as to drive

the magazine on through the breech when the bolt/plate combination is drawn back, and then further on when the bolt/plate is pushed forward again. The guides may take a number of specific forms, but basically they are low walls projecting from the plate surface that act as cam surfaces to drive the relevant pin (acting as the cam follower) in the required direction. More particularly, they are a pair of walls each at a suitable angle to the line of movement of the plate -  $45^\circ$  or less (perhaps  $35^\circ$ ) is satisfactory - one to the left, one to the right, with one wall to the front and the other to the rear. As the bolt/plate combination is pushed forward, the front face of the rear wall picks up the relevant next pin and drives it (and thus the magazine) sideways to the position where its associated throughhole is aligned with the chamber (and most preferably releasably secures it in that position until the bolt/plate is withdrawn); as the bolt/plate combination is withdrawn, the rear face of the front wall engages with that pin and drives it (and thus the magazine) sideways, out of alignment, but bringing the next pin to the point where it can be picked up by the rear wall on the forward stroke. It will be apparent that the front wall must be both relatively short in the left-to-right direction because it has to pass through the line of the pins, between adjacent pins, on the forward stroke (and this is one factor that limits the pin spacing). Moreover, the front wall must have a clear rear "cam" face, and the rear wall a clear front "cam" face, because the pins actually pass behind the front wall and before the rear one.

The front wall is conveniently an inclined wall - an actual wall - though it could be the inclined surface of a wedge. The rear wall, however, is preferably an inclined surface (a wall having considerable depth) with

an associated slot cut deep thereinto in the necessary position securely to locate the pin, and thus the throughhole, exactly aligned with the chamber as the bolt is inserted into the hole to push the pellet therein out and into the chamber. This is shown in the accompanying Drawings.

Having the pins offset slightly in the direction opposite to that in which the magazine is driven - with the guides correspondingly offset - means that a slightly larger feed movement can be achieved during the forward stroke than during the rearward stroke, minimising the chance of a mis-index backwards to the previous throughhole.

Although the indexer plate (and its bolt attachment means) could lie open to view, and to fingers, especially when positioned over the top of the breech, it is best to protect everything with a cover plate attached thereover and suitably secured to the breech block.

One particular advantage of the magazine system of the invention, at least in its preferred form, is that it may be retro-fitted to an otherwise conventional airgun with only the most minor changes to the structure of the gun itself

The system of the invention can be used with a semi- or even fully-automatic weapon, where the cocking - the withdrawing of the bolt, and its subsequent forward motion - is carried out automatically, driven by gas from the source (or perhaps spent gas from the just-occurred discharge).

An embodiment of the invention is now described, though by way of illustration only, with reference to the accompanying Drawings in which:

Figure 1 shows a side view of a conventional airgun having a canister of pressurised air;

Figure 2 shows a vertical section along the breech of an airgun of the Figure 1 type fitted with a magazine system of the invention;

Figures 3A to 3B show plan views, partly in section, of the magazine system of Figure 2 in bolt forward, bolt retracted and bolt midway set-up; and

Figures 4A to 4B show underneath perspective, top perspective and side sectional views respectively of the indexer plate, magazine and throughhole of the magazine system of Figure 2.

The airgun shown in Figure 1 is a conventional gun of the sort having a pressurised canister of air attached thereto. The gun has a barrel (11) at the butt end (the right end as viewed) of which is a chamber (12) fed from a breech (13, as an opening in the breech block 13b; a pellet - 21 in Figure 2 - is normally placed manually in here) by a bolt (14) that is pulled out and pushed in manually using the end grip (15). Underneath the barrel 11 is the air canister/reservoir (16; chargeable with air by means not shown), which is connected (by means not shown), via a trigger-operated valve mechanism (only the trigger itself, 17,

is shown) to the chamber 12 by an inlet (22: shown in Figure 2) just behind the point to which the pellet is pushed by the bolt 14.

Figure 2 shows the breech/breech block part of the Figure 1 gun modified, in accordance with the invention, to incorporate a magazine mechanism of the invention. The magazine (23: see also Figures 3 and 4B and 4C) is an elongate oblong section block that in use sits across the breech 13 (see Figures 3) and moves in its lengthwise direction sideways through the breech. Upstanding from its upper surface (24: upper as viewed) is a succession of indexing pins (as 25), and in the body of magazine is a like succession of throughholes (as 26) in each of which is stored a pellet 21. From Figure 4C it can be seen that each throughhole has a small inwardly-directed lip (23<sub>l</sub>) at the rear (the left, as viewed) and an O-ring (23<sub>o</sub>) at the front (the right), and that this combination will keep the pellet in place until it is pushed out by the forward end (27: Figure 2) of the bolt 14.

Adjacent (and above) the breech/breech block 13/13<sub>b</sub> is the indexer plate (28) carrying on its undersurface (that immediately adjacent the breech) a pair of guide walls (31, 32: best seen in Figures 3 and 4A). The front wall 31 is a freestanding wall inclined to the direction of travel of the plate 28, while the rear wall 32 is in fact a combination of inclined surface and deep slot (32<sub>s</sub>). At its rear, the indexer plate 28 is attached to a rod (33) that extends rearwardly to near the handling knob 15 at the end of the bolt 14, to which it is there joined by a ring-ended arm (34) fitting loosely into a corresponding groove (not shown separately) near the end of the bolt 14 so as to allow

the bolt to turn around its axis without thereby turning the arm/rod, but at the same time securing the arm on the bolt so that back and forth motion of the latter causes similar motion of the former.

Above the breech/breech block and the indexer plate (and its connecting rod 33) is a cover (36) secured to the breech block 13b fore and aft (by means not shown), with an aperture at the rear out through which the rod 33 extends.

The operation of the magazine system of the invention is best seen from the sequence of Figures 3A, 3B and 3C. Starting with the bolt pulled right back (3B), and a magazine inserted into the breach (from left to right as viewed), the bolt, and thus the arm/rod/indexer plate 34/33/28, is pushed fully forwards. As it travels (through a position akin to that of Figure 3C), the front indexing guide wall 31 passes by the first indexing pin 25, and the rear guide wall surface 32 picks up the pin, driving it - and the magazine to which it is attached - to the right (as viewed). Just before the front end 27 of the bolt 14 enters the lipped rear of the throughhole 26 the pin reaches and enters the guide slot 32s, and subsequent movement of the bolt/plate keeps the pin firmly positioned in the slot, and the bolt end 27 drives the pellet out of the throughhole 26 (through the O-ring barrier 23o) and into the chamber 12 (Figure 3A). Then, after the trigger has been pulled (and the pellet fired), the bolt 14 is withdrawn. As it comes back, bringing the indexer plate with it, just after the bolt end 27 has cleared the throughhole 26 the plate's front guide wall 31, which overlaps the slot 32s, picks up the pin 25 on its rear surface and drives it further to the



right, so moving the magazine bodily to the right as well, until the situation is back to that shown in Figure 3B.

The cycle may be repeated by working the bolt, until all the pellets have been fired, the last pin 25 has been driven to the right by the guide wall 31, and the magazine may be removed.

CLAIMS

1. A magazine system for use with an airgun of the sort having a source of pressurised gas feedable to an inlet into a chamber, a breech into which is loaded a pellet, and a bolt to push the pellet into the chamber to and past the gas inlet, which system comprises a combination of:

a magazine pellet carrier with an elongate body and a multiplicity of spaced pellet-holding throughholes therein and a like number of indexing pins projecting therefrom orthogonally to holes and body, each pin associated with its own throughhole, the magazine adapted to fit across the breech with any one of its succession of pellet-carrying holes aligned with the chamber,

together with a magazine-advance mechanism attached to and operated by the bolt, the mechanism comprising an indexer plate projecting forwardly of the bolt adjacent the breech, and carrying on its breech-adjacent surface indexing guides that interact with the indexing pins of a magazine placed in the breech and by so doing cause the magazine to be driven bodily sideways through the breech as the bolt is worked, until the next throughhole is aligned with the chamber, so that the subsequent forward movement of the bolt pushes the pellet in that hole out and into the chamber.

2. A magazine system as claimed in Claim 1, wherein the throughholes in the carrier are provided with pellet-retaining means at both the front and the rear ends of the hole.

3. A magazine system as claimed in Claim 3, wherein the pellet-retaining means comprise an O-ring of elastically-deformable material mounted at the front of the hole, and a small inwardly-projecting lip at the rear.
4. A magazine system as claimed in any of the preceding Claims, wherein there are six throughholes.
5. A magazine system as claimed in any of the preceding Claims, wherein the indexing pins project from the top edge of the magazine (when in situ).
6. A magazine system as claimed in any of the preceding Claims, wherein the pins are slightly offset towards the side opposite to the magazine feed direction, to stand mainly in the spaces between holes.
7. A magazine system as claimed in any of the preceding Claims, wherein the indexer plate is above the breech and attached to the bolt so that as the bolt moves back and forth so the plate moves likewise.
8. A magazine system as claimed in Claim 7, wherein this attachment takes the form of a rearwardly-pointing rod extending back well behind the breech block and there secured by a short crank arm to the bolt near its rear end, the crank arm being so secured to the bolt that the bolt may be axially rotated (to lock it into the breech-closed position) without the arm/rod/plate trying to rotate as well.
9. A magazine system as claimed in Claim 9, wherein the crank arm is attached to the bolt by a ring coupling fitted loosely around the bolt in a shallow groove formed therein.
10. A magazine system as claimed in any of the preceding Claims, wherein the indexing guides take the forms of low walls projecting from the plate surface

that act as cam surfaces to drive the relevant pin (acting as the cam follower) in the required direction.

11. A magazine system as claimed in Claim 10, wherein the indexing guides are a pair of walls each at an angle of 45° or less to the line of movement of the plate, one to the left, one to the right, with one wall to the front and the other to the rear.

12. A magazine system as claimed in Claim 11, wherein the front wall is an actual inclined wall, while the rear wall is an inclined surface with an associated slot cut deep thereinto in the necessary position securely to locate the pin, and thus the throughhole, exactly aligned with the chamber as the bolt is inserted into the hole to push the pellet therein out and into the chamber.

13. A magazine system as claimed in any of the preceding Claims, wherein the indexer plate (and its bolt attachment means) are protected with a cover plate attached thereover and suitably secured to the breech block.

14. A magazine system as claimed in any of the preceding Claims and substantially as described hereinbefore.

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**Patents Act 1977**

**Examiner's report to the Comptroller under  
Section 17 (The Search Report)**

Application number

9109502.6

**Relevant Technical fields**

(i) UK Cl (Edition ) F3C, CFJ, CSB, CSD

(ii) Int CL (Edition ) F41B 11/00, 11/02

Search Examiner

PAUL GAVIN

**Databases (see over)**

(i) UK Patent Office

(ii) ONLINE WPI

Date of Search

12 JUNE 1992

Documents considered relevant following a search in respect of claims

ALL

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2202311 A (RICHARDSON) - whole document	1
A	GB 2152646 A (HUTCHISON) - whole document	1
A	WO 88/0625 A1 (CHEVALIER) - see particularly page 8 line 28-page 9 line 5	1 and 2
A	EP 0416394 A2 (STEYR-DAIHLER-PUCH) - see particularly magazine 19, Figure 2	1
A	US 4004566 (MINNESOTA M & M CO) - see Column 3 line 38 to Column 4 line 35	1
A	DE 3728080 A (I D L V) - see magazine slide 11	1

Category	Identity of document and relevant passages	Relevant to claim(s)

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**P:** Document published on or after the declared priority date but before the filing date of the present application.

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